

Dr. Parsons's Report to the Local Government Board on a recent outbreak of Enteric Fever in the Borough of Buckingham.

GEORGE BUCHANAN,
Medical Department,
June 8th, 1888.

In the latter part of March 1888, information reached the Local Government Board from several sources of a somewhat extensive outbreak of fever in the borough of Buckingham, and I was instructed to inquire into its cause. On visiting the town on April 3rd I found that from the beginning of the year up to that date about 114 cases of fever had occurred, in 49 households,* and with, so far, five deaths, including one which took place after removal of the patient to another district.

The majority of these cases, though not of the deaths, occurred in an outlying quarter of the borough called Church End; the remainder chiefly in the more central parts of the town: the outbreak at Church End differing from that in the remainder of the borough, in incidence, in character, and probably in cause.

The parish church, Market Square, and principal streets of Buckingham stand on a hill which is surrounded on three sides, viz., N.W., S.W., and S.E., by the river Ouse, forming an oblong peninsula. On the N.E. a long wide street, North End, stretches away from the Market Square. The other streets mostly descend the hill towards the river and are narrow and crooked. The quarter called Church End (which, however, is not near the church) lies to the S.W. of the town on the other side of the river, and consists principally of three streets—Mitre Street, Bath Lane, and Gawcott Road—which meet at one point. Of the last named street, one side is out of the borough, being in the parish of Radclive in the Buckingham Rural Sanitary District, but except as regards administration it is practically a part of the town.

General description.

The population of Buckingham in 1881 was 3,585, of which about 3,000 are in the town proper, the remainder in outlying hamlets: it is believed to be stationary as regards numbers. The inhabitants are employed in the usual professional, commercial, and industrial avocations of an agricultural market town; there are no manufactures, and there is said to be at present a good deal of poverty.

There are a good many old cottages which are badly built, ill-ventilated, dilapidated, and too small for the families which inhabit them; many of those at Church End are of this class. Some of the houses have little external space belonging to them; and some indeed have none at all, and this not only in the centre of the town, but also in outlying lanes, where cottages have been built on strips of waste land by the roadsides. The sites of some of the

Dwellings.

* Including 22 cases in six households in a portion of the Buckingham Rural District closely adjoining the town.

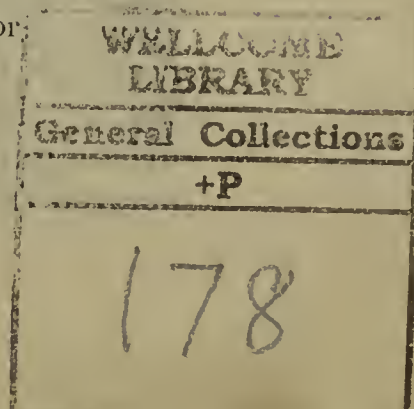
LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C.; or
ADAM AND CHARLES BLACK, 6, NORTH BRIDGE, EDINBURGH; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1888.

Price 6d.

No. 25.



houses are damp, being partly excavated out of sloping ground, or near the river, which is held up by mill weirs, and is very subject to floods. The soil is gravel and cornbrash, resting on clay.

There are no byelaws for the regulation of new buildings (nor indeed of any kind), but the question of adopting byelaws is under the consideration of the Town Council.

Sewers and
drains.

The sewage of Buckingham is drained into the Ouse, and owing to the way in which the river encircles the town, so that no part is very far distant from it, the outfalls are numerous, and the individual sewers are for the most part not of very great length. The course and construction of the sewers are imperfectly known, as they have been constructed at various periods, and no plans of them have been kept; but enough is known to show that they are very defective. Those constructed in the last 10 or 12 years are of socket pipes, but some of the older ones are brick culverts, or square stone drains with bare earth bottom and irregular fall. There are catchpits in their course three feet deep below the invert of the sewer to retain the grosser sediment. Private cesspools, with or without overflow into the sewers, also exist in the town. The sewers have no means of ventilation other than such inlets as may have been left untrapped, and which are often too near houses. Nor have they any regular means of flushing, the only means being to pump water into them from the river with a fire-engine. It is said that when this was recently done none of the main sewers were found blocked, though some contained four or five inches of sediment, but many of the house drains were quite blocked up.

The newer house drains are of glazed socket pipes, but the older ones are of common unsocketted agricultural pipes, or are square "mason's drains" of brick or stone; and they not unfrequently run under houses. The inlets are often inside the houses, or, if outside, are near the doors, and they are frequently untrapped or imperfectly trapped. No means of drain ventilation have been provided, except occasionally a pipe, usually of small size with many bends, carried up from the soil pipe of an indoor watercloset.

Closets.

Various kinds of closet are in use. The old form is the vault-privy with large deep underground pit, not emptied for years together, but many of these have of late years been done away with, and improved forms substituted. One kind of privy in use has a small cemented pit under the seat; and there are also many privies with movable boxes or pails.

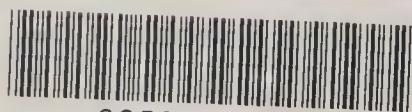
Earth closets have in a few cases been introduced, but in one instance seen the results were very unsatisfactory, owing to ashes being substituted for dry earth in an apparatus intended for the use of the latter. The larger houses have indoor waterclosets; and there are also many closets with hopper and drain connected with the sewers and flushed by pouring down water by hand. Owing to the often insufficient quantity of water used for flushing, where it has to be raised and carried by hand, many of these hopper closets were found in a very unsatisfactory condition, and an extension of the system does not seem desirable until better drains and a more abundant water supply are available.

Some of the old privies are also connected with the sewers, so that these receive a good deal of faecal matter.

The Corporation undertake the scavenging of box and pail privies, and these are said to be now visited once a week (though there is said to have been until lately a good deal of laxity in this respect); but they do not undertake the emptying of the old vaults.

Water
supply.

The water supply of Buckingham is mostly derived from pumps and wells, public and private, but Church End is supplied by a copious and unfailing spring, the Bath Lane spout, at the junction of Bath Lane, Mitre Street, and Gawcott Road; of which more hereafter. The wells in the town are of moderate depth, about 30-40 feet, and are said to yield a good supply of water. Water, however, obtained from wells so situated must be looked upon as suspicious, for as the town is nearly cut off by the river valley from any large extra-urban gathering ground, the water which the wells yield must be largely derived from the rain which has fallen upon the area of the town, and which



in its way would carry with it impurities from the surface, and from leaky drains, cesspools, &c. It is rarely the case that the upper part of a well is made watertight with a view to exclude soakings from the surface soil.

The following incidents told me by residents in Buckingham show how porous the upper strata in the town are.

At a house in the centre of the town, the watercloset drains into a cesspool, the overflow of which goes into a second cesspool. The first cesspool is emptied every year, but the occupier of the house told me that the second cesspool had not required emptying during the 25 years that he had resided there.

In a yard in another part of the town some paraffin oil was spilled on the ground; shortly afterwards the water in the well was found to taste and smell of the oil, and a few weeks later that in a well at the next house but one also did so. This happened last year and the taste and smell of the oil are said to be still perceptible after heavy rain, though not in dry weather.

In some of the outlying parts of the town, water has to be fetched a considerable distance. This is especially the case at Mount Pleasant, alluded to in the reports of the medical officer of health, an outlying row of cottages of a poor class: here water has to be fetched from a dipping well some 400 yards distant.

It would appear from the annual reports of the medical officer of health, and from the statements of medical practitioners in Buckingham, that cases of enteric fever, more or fewer, occur in the borough every year. During the 10 years 1877 to 1886, the average annual death rate from fever (almost entirely enteric) was $\cdot 36$ per 1,000, the average rate for England and Wales during the same period having been $\cdot 30$, and in those years there were local groups of cases in places where defective sanitary conditions were reported to exist.

Enteric
fever.
Previous
prevalence.

In the autumn of 1887, four cases in widely separated parts of the borough came to the knowledge of the medical officer of health. The first of these, Beckett, was a girl, a servant at an hotel, and hence perhaps exposed to the risk of imported infection, who about October 7th went home ill to an outlying cottage. At this cottage there was a foul privy, and the well water was polluted, but the disease did not spread there. Another of the cases, about a month later, was that of a farm boy, Colman, living at the top of the Gawcott Road at the opposite end of the borough, but who passed the above-mentioned cottage every day on his way to and from his work, though he is not known to have come into contact with its inmates. Close to the house in which he lived is an offensive untrapped drain grid, and an unpaved sewage-sodden yard. The privy, which is built against the next house, had previously been reconstructed with a shallow cemented pit occupying merely the space under the seat—a form of privy which may be admissible under suitable circumstances, and when not too near a house—but with singular wrong-headedness the water from the roof of the next house had subsequently been led by a pipe into the privy pit, and then to get rid of it again a hole communicating with the drain had been knocked through the bottom of the pit. Hence the excreta of the fever case thrown into the privy would infect the sewer which runs down the Gawcott Road. (This sewer is a 9-inch pipe sewer with a steep gradient; it is unventilated except by the drain inlets, from which offensive smells are said to proceed.)

Cases in
1887.

In January and February 1888, an extensive outbreak of enteric fever occurred in Gawcott Road, Bath Lane, and Mitre Street, Church End. During those two months 25 households in Church End were invaded by the fever, the number of cases in these households being about 80. (These numbers include 22 cases of fever occurring in six households on that side of the Gawcott Road which is in Radclive parish, and therefore just outside the border of the borough.)

Sudden
outbreak at
Church End
in Jan. and
Feb. 1888:—

The first of these cases, that of Paul Soton, age 13, living on the Radclive side of Gawcott Road, came under medical treatment on January 1st, when he was undoubtedly suffering from enteric fever, but he had then been ill for several weeks with abdominal pain, diarrhoea, and wasting, and on December 26th had been markedly worse, with profuse vomiting and discharge of very offensive peasoup-like stools streaked with blood. He had therefore no doubt been suffering from enteric fever for some time before

January 1st. This boy had not been so far as known in communication with the previous case at the top of the road. The Sotons' cottage, however, is not drained into the road sewer, but into a drain at the back. This drain is of very imperfect construction, full of sediment, and often blocked: it also receives the contents of the privy into which, up to January 1st, the boy's excreta were thrown. After the nature of his illness was recognised, the excreta were by the advice of the medical attendant disinfected and buried in the earth.

among persons drinking water of Bath Lane spout exposed to pollution by sewage infected by the excreta of the first case.

As before mentioned the water supply of Church End is almost wholly obtained from the Bath Lane spout. This is a copious stream of water running some 10 gallons per minute, which, coming from a spring in the hillside above, is brought down, first in a rubble stone conduit, and then in one of socket pipes, to the iron spout from which it issues. (See annexed plan.) The spout itself is just within the borough, at the junction of Gawcott Road, Bath Lane, and Mitre Street, but the spring and the conduit are in the Rural District. Some 50 feet above the spout the line of the conduit is crossed, as shown at B. in the plan, by the drain lately mentioned: this drain has at this point received the sewage of eight houses (including Soton's, in which the first case of fever occurred); the privies, which are of very rude construction, are connected with it, and into one of them a small stream of water from a spring is led with the view to wash away the excreta. The drain, which occupies the course of an old ditch, has been laid in the greater part of its course only with common field pipes: it was, I saw, so constructed in the neighbourhood of the conduit, where the joints between the pipes gaped widely and the drain was half full of black sediment. Immediately over the course of the conduit was a small catchpit-inlet with bottom of bare earth. Just below where it crosses the conduit the drain runs through a larger catchpit on a different property, and it is said that here it was sometimes intentionally stopped, owing to neighbourly disputes, with the result of causing sewage to well out from the drain higher up. Whether this happened or not, leakage of sewage from the drain could not help taking place, and, as I saw, the earth in which the water-pipes were lying beneath the drain was black, foetid, and sewage-sodden. The joints of the water-pipes nearest the drain had been luted with mortar, but on plugging the conduit below, a stream of water issued from one of them, where a bend had been made by inserting one pipe obliquely in the socket of another. This particular leakage indeed may have been due to a crack made in uncovering the pipes, but at any rate the third joint below the crossing of the drain, and others below it, were not luted, and here ground water (and worse) could enter the conduit, which in fact would drain the soil in the same way as an agricultural drain.*

There is therefore good reason to believe that sewage leaked out of the drain, and found its way into the drinking water. The amount so entering would no doubt be very small relatively to the volume of the stream of water, and hence slight pollution may probably have been going on for a considerable time, but escaped notice until the sewage happened to become infected with the fever poison, and then an extensive outbreak of fever among the drinkers of the water was the result. Hence in my opinion this outbreak is to be classed with those which have been recorded, *e.g.* at Caterham† and Bangor,‡ resulting from the entrance of a relatively minute quantity of specific fever poison into a water of pure origin.

The water has hitherto borne a high reputation, and at its source in the hillside can hardly be anywise polluted. Analyses made recently by the borough analyst led to its being classed as a first-class water, and showed scarcely any excess of foreign constituents above the water of another spring in the same hillside. (See Appendix.) On these grounds there was in some quarters a disinclination to admit that the water could have had any share in the production of the fever; but it has been shown by the instances referred to, that typhoid fever may be produced by drinking water containing

* There was also near the conduit a privy with cesspit, which at a later stage received typhoid excreta.

† Annual report of medical officer to Local Government Board, 1879.

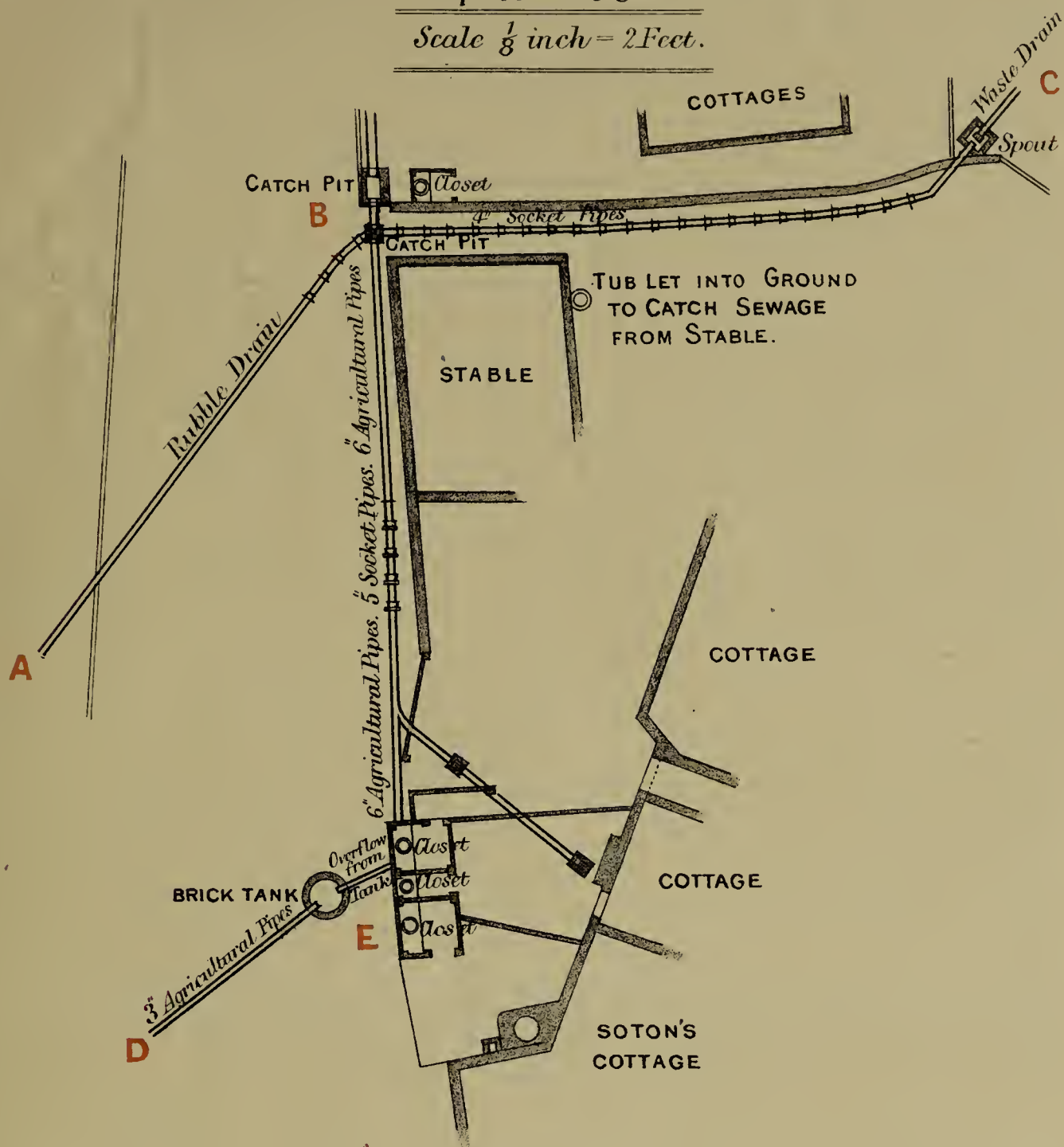
‡ Do. do. do. 1882.

I. PLAN.

BATH LANE WATER SUPPLY
BUCKINGHAM.

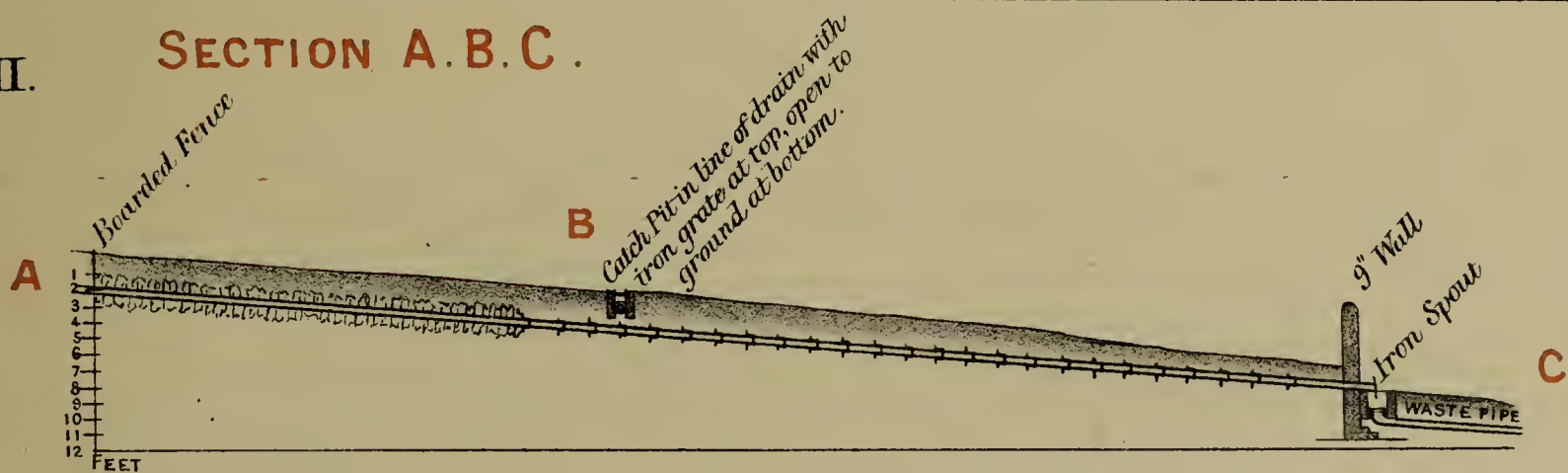
April 1888.

Scale $\frac{1}{8}$ inch = 2 Feet.



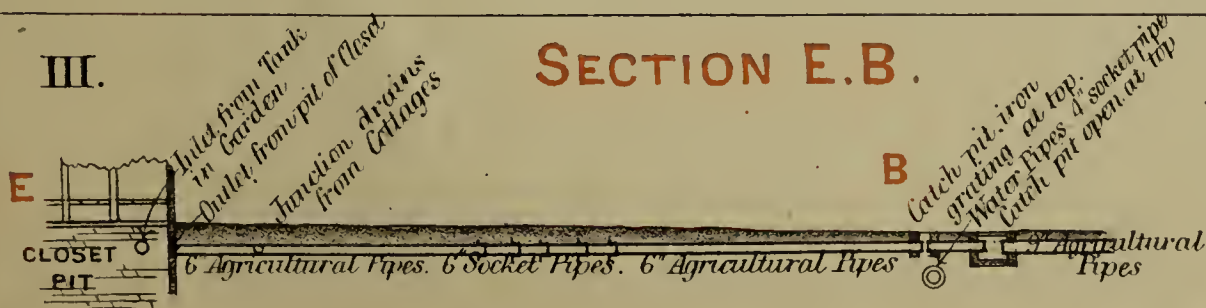
II.

SECTION A.B.C.



III.

SECTION E.B.



IV.

SECTION E.D.



the specific poison of that disease, even though* the total amount of pollution present may be so small as to be undiscoverable by chemical analysis.

If further illustration be needed of the inability of a chemist to prove the quality of organic matter in water where its quantity is small, I may quote a report which was shown me by one of the Buckingham Town Council, made by the same analyst on a sample of water taken from the River Ouse at a point below where it has received the sewage of Buckingham. The analyst, after noting the presence of some excess of organic matter, says that the water "does not appear from the analysis to contain sewage matters." (*See Appendix II.*)

Another objection made to the water hypothesis is that without it the state of the drains, closets, &c., at Church End, is quite sufficient to account for the occurrence and spread of the fever. Doubtless the state of many of the drains and privies is, or was, very bad,—it could hardly be worse,—and eminently calculated to spread disease. In particular I may mention that the drain which carries away the waste water from the Bath Lane spout is untrapped, and is so placed that people coming to the spout to fill their vessels cannot avoid inhaling the offensive effluvia which issue from it. But while I have no doubt that the bad state of the drains and privies has assisted in the spread of the disease, I think that the character and circumstances of the outbreak, and especially its comparatively sudden and widespread extension over the area in which the water is in general use, but which is drained by several different sewers, point rather to the former as being the principal medium by which the morbidic poison was conveyed.

The history of the epidemic accords with this view. Of the next cases after Soton, indeed, two were in neighbouring houses using the same drain, and the third was an officer in the Salvation Army who in the course of his duties had frequently visited the sick. But in the end of January and the beginning of February (by which time it may be supposed that the infected sewage slowly percolating had had time to reach the water and produce its effects) a number of different households were attacked, and in every one the Bath Lane spout water was drunk.

The following shows for the borough (inclusive of houses on both sides of Gawcott Road) the number of cases commencing in each month (so far as the dates could be fixed) among those who did and who did not use this water; the first cases only in each household being reckoned:—

| Households of Borough. | Number- ing. | Oct. | Nov. | Dec. | Jan. | Feb. | March. |
|-----------------------------|-----------------|------|------|------|------|------|--------|
| Using Bath Lane water - | 78 | — | 1† | 1 | 8 | 17 | 4 |
| Not using Bath Lane water - | 616 | 2 | 1 | — | — | 7 | 12 |

† Rarely.

From December up to the middle of February every household attacked with fever was one in which the Bath Lane water was in use.

One of the households where the Bath Lane water was used (attacked towards the end of February) was in a different part of the town, but the water was said to be boiled before use.

On February 14th the medical officer of health in reporting on the outbreak of typhoid fever recommended that the Bath Lane water should be boiled before drinking, and that the watercourse to the spout should be carefully examined. (He had, so far back as June 28th, 1886, called the attention of the Town Council to the drain from Soton's cottage, but no action was taken on this advice, and it turned out that the drain in question was in the Rural Sanitary District.) About March 16th the watercourse was opened out, and as a temporary measure a basin at which vessels could be filled was placed to receive the water above the site of pollution.

After the end of February only four new households using the Bath Lane water were invaded by fever; in some of these the water was little or only occasionally used, and in every one the persons first attacked had been in close communication with previous cases. The causes of the decline of the

* *See Dr. Cory's Report in volume for 1881.*

fever at Church End in March cannot be stated with certainty, but the following considerations no doubt help to an explanation of the fact. Many of the susceptible persons had by that time had the disease. Some people ceased to drink the Bath Lane water, or adopted the suggestion of the medical officer of health to boil it. Again the supply of specifically infected matter may have become exhausted, for though a succession of cases occurred in Soton's family, one of which had not yet recovered at the time of my visit, and others in other households using the same drain, yet I am assured that as soon as the cases were recognised the excreta were not thrown into the privy, but disinfected and buried in the earth.

Subsequent extension of fever to other parts of borough

In the latter part of February cases of enteric fever began to crop up in other parts of the borough, among persons who had not drunk the Bath Lane water, and more occurred in March. They have occurred in a scattered fashion, and in various parts of the district, but in several instances two persons living in neighbouring houses have been taken ill about the same time. The main street called North End appears to have wholly escaped.* Cases occurred at an outlying row of cottages called Mount Pleasant, on the same side of the river as Church End; these are at the head of a long unventilated sewer connected with that in Mitre Street, but water is got from a dipping well, not from the Bath Lane spout. The other cases occurred in the central part of the borough, with the exception of a group on the London Road, on the same side of the Ouse as Church End, but (owing to the circuitous course of the river) on the opposite side of the borough.

probably due to sewer air.

At most of the houses attacked defects of drains or closets were found, such as would permit the entrance of drain air into the houses, and this state of things I look upon as having been probably the principal cause of the later spread of the fever, the sewers in the town having by some means received germs of infection from the previous cases in Church End. A difficulty however arises from the fact that the houses invaded were on several different sewer systems; one or two were drained independently into the river.

Two circumstances may be noted in this connexion.

On February 13th and 14th there was a very heavy fall of snow which lay on the ground for a month. The cold weather would favour the entrance of drain air and ground-air into the houses, as windows and doors would be kept shut and large fires kept up.

On March 1st and 2nd a thorough flushing of many of the drains was carried out. Before this was done many of them were in a more offensive state than at the time of my visit.

The water supply of the houses invaded came from a number of sources.

In some instances it seemed probable that the fever might have been contracted at work, or in visiting the parts of the town different to that in which the patient resided, but in two instances the patient had been confined to the house for some weeks before the fever began.

Milk supply probably not concerned.

The milk supply of the whole borough is mainly derived from two dairy farms, and milk from one or other of these sources, or sometimes from both, had been used by most of the persons who contracted fever.† At the same time one or two had had milk from a third source, and a few had used no milk before their illness. The two dairy farms, which adjoin one another, though unconnected, are situated at the top of the Gawcott Road outside the borough in an open situation, and not very near any house where fever existed, though the milk on its way to the town would be carried through Church End. It is conveyed in hand carts, and sold wholly in Buckingham, none being sent elsewhere. At one of the farmhouses (P.) water for drinking, but not for dairy purposes, was obtained from the Bath Lane spout; a maidservant at this farmhouse went home ill of fever about February 8th, but her parents resided near Soton, and she may have contracted the disease in visits to her home. There is nothing to show that milk from either source had any share in the spread of the fever.

* In 1877 a local outbreak of enteric fever occurred in North End. Three persons now living in Church End, who have recently had enteric fever, are said also to have suffered from it on that occasion.

† In 50 households affected with fever, the milk sources were, R. 20., P. 11., R. and P. 6., M. 1., None 6., not ascertained, 3.

I have said in an early part of this report that there was a considerable difference in the incidence and behaviour of the fever as it occurred at Church End, *i.e.* among the drinkers of Bath Lane water, and in the rest of the borough. In Church End the disease had a more extensive prevalence but was milder in character, and it fell specially on children.

Different character of fever at Church End and in rest of borough.

In Church End out of about 78 houses 30, or 38 per cent., were invaded by fever, whereas in the rest of the town out of about 616 houses* only 18, or 3·1 per cent.,—less than a tenth of the former proportion,—were invaded. The greater proportion attacked in Church End indicates a more generally acting cause, such as the pollution of a common water source. Again the proportion of cases per house was greater in Church End; in 30 households there were 88 cases, or on an average nearly three cases per household attacked; in the rest of the borough in 19 houses there were 26 cases or not quite 1·5 per household. The larger proportion of cases per house in Church End is probably due not alone to the larger number of those originally infected, but also to the circumstances of the houses being such as to conduce to the spread of the disease among the members of the family, many of the cottages at Church End being small, close, and overcrowded, with dirty surroundings and interiors. In the other parts of the borough the houses are on the whole larger and of a better class than those at Church End, and at a later stage of the epidemic precautions are more likely to be taken against the spread of the disease than at first.

In former more extended.

In some of the households attacked several of the cases were said to have been taken ill within a few days of one another, indicating a common cause: in others secondary cases occurred after a lapse of 10 days or more, so that they might have been contracted from the first. Owing however to the frequently insidious onset of the disease, it was often not possible to fix accurately the date of commencement. The frequent instances of multiple cases in one family as well as instances in which the disease appeared to be contracted in visiting or attending on the sick (though the influence of unsanitary conditions cannot be wholly excluded) point to the disease being directly communicable from person to person under the actual sanitary circumstances of Buckingham. It is sometimes said "typhoid fever is not infectious," but such an unqualified assertion is likely to do much mischief. In hospitals where abundant air space and ventilation are provided, and cleanliness and disinfection of excreta are carefully attended to, it may not spread from person to person, but in the cottages of the poor, where these conditions do not obtain, it can and does.

As it occurred in Church End the disease affected principally children: of 88 cases, five were adult males, 15 adult or adolescent females, and 68 children under 15 years old. Or taking only the initial cases in 30 households, three were men, six women and girls over 15, and 21 children under 15. In the remainder of the district this proportion did not obtain: of 30 cases four were males above 15, 12 females above 15, and 14 children under 15; or of initial cases in 19 households two were males above 15, 10 females above 15, and seven children. The greater incidence of the disease upon children at Church End is consistent with water being the medium of infection, children being large water drinkers. The greater incidence upon women than men, in both parts of the district, may be explained on the one hand by their drinking more water, and on the other by their more frequently coming in contact, in the course of their domestic occupations, with foul air from drains and sinks, and by their being more frequently in attendance upon the sick.

Principally attacking children.

By the testimony of all the medical men in Buckingham the cases of fever at Church End were of a much milder character than those in the rest of the borough. There were well marked cases among them, but many cases were so mild that they would hardly have been recognized if they had not occurred in association with others; among 88 cases there was only one death. In the other part of the borough many of the cases were well marked and severe, and among 26 cases there were four deaths. The small mortality at Church End may have been partly due to the fact that many of the patients were children, among whom enteric fever is a less fatal disease than among adults; but perhaps also to the mode in which the disease was contracted. In

And milder.

* Taking the inhabited houses in the borough as 798 as in 1881, and allowing 182 for houses in Church End and outlying hamlets.

reporting on the Caterham outbreak in January and February 1879, an outbreak caused by the contamination by a relatively small quantity of specifically infectious excreta of a large volume of otherwise very pure water, and which like the present one occurred in very cold weather, Dr. Thorne writes (*loc. cit.* p. 90) that "by far the majority of the cases were of an exceptionally mild character, and although when subjected to examination they were ascertained to be cases of genuine enteric fever, it is certain that had it not been for the prevailing epidemic no medical advice would in many cases have been sought, and some of the patients would not even have taken to their beds. By far the majority of those attacked were children, and amongst adults women were more frequently attacked than men. This distribution of the disease is by no means uncommon in epidemics in which water is the vehicle in which the infection is conveyed, for children drink much more water than adults, and amongst the latter men as a rule drink less than women."

Action of
Town Council.

The sanitary defects noted in this report, *e.g.* defective sewers and drains, foul privies, water sources in danger of pollution, and houses unfit for habitation, have for the most part been frequently brought under the notice of the Town Council both by the present medical officer of health, Mr. G. H. De'Ath, and by his father and predecessor in the office, the late Mr. R. De'Ath, who have also urged the desirability of adopting byelaws for the regulation of new buildings, and making some provision for the isolation of cases of infectious disease, and the Local Government Board have by correspondence repeatedly called the attention of the Town Council to some of these matters, but hitherto, except as regards the improvement of privies and removal of their contents, only rectification of individual nuisances appears to have been attempted and no action of a comprehensive kind taken.

A special meeting of the Town Council was held on March 9th to consider the state of the town in view of the then prevalence of typhoid fever. At this meeting it appears to have been generally admitted that the sanitary condition of the town required more attention than had hitherto been given to it, and a Committee was appointed to carry out the necessary improvements. The ground about the Bath Lane spout was opened about March 16th, and the state of things described on a former page of this report was discovered. As it appeared that the source of the water supplying the Bath Lane spout, and the drain by which its wholesomeness was endangered, were both situated in the district of the Buckingham Rural Sanitary Authority, the co-operation of that body was very properly sought. The Rural Authority accordingly appointed three of its number to work with the Committee of the Town Council, and the same medical officer of health and inspector of nuisances act for both authorities. An iron basin at which people could fill their vessels was inserted in the course of the water-conduit above any source of pollution. At the time of my visit it was proposed to bring down the water to the spout in galvanized iron pipes, laid in the old course for some little distance above the drain.* I suggested, however, that the spring should be intercepted at the highest practicable point in the hillside, and the water received into a tank from which it could be brought down another way to stand posts: this would both still further obviate risk of pollution, and would enable the supply to be extended to more distant parts of the town, where water has now to be fetched by hand from the spout. My suggestion received the courteous consideration of the Committee.

At the time of my visit new closets were being built for the row of houses in which Soton lived, and the drain was to be reconstructed. In the urban district also certain structural improvements of house drains had been made and privies reconstructed.

As before mentioned, the sewers and drains in the Church End and the lower parts of the town were on or about March 2nd thoroughly flushed out by the aid of a fire engine with water from the river, and a large quantity of sediment removed, and this flushing was being repeated on April 17th.

In the absence of a place for the reception of persons suffering from infectious disease, measures of isolation were in most cases impracticable.

* At a subsequent visit (April 17th) I found that this arrangement had been carried out. The offensive drain carrying away the waste water from the spout had not been trapped.

Disinfection and burying of excreta seem to have been generally advised and to some extent at least carried out.

At the request of the Sanitary Committee I met them before leaving the town and conferred with them as to the measures more immediately necessary to be taken to prevent the further spread of the fever. I recommended that the sewers should be periodically flushed, and disinfectant solution poured down them; that the inhabitants should be advised to drink no water that had not been previously boiled; that the abatement of nuisances, especially from defective drains and privies, should be pressed with all possible despatch; that the emptying of closets should be frequently and systematically carried out; and that the Authority should endeavour to obtain some building suitable for the isolation of persons suffering from infectious diseases.

I have to express my obligations to the members and officers of the Town Council, and especially to Mr. De'Ath, Medical Officer of Health, and Mr. Munday, Inspector of Nuisances, for assistance rendered me in my inquiry.

H. FRANKLIN PARSONS.

April 18th, 1888.

APPENDIX I.

(Reference No. 716.)

TO SUPERINTENDENT NOBES.

REPORT of the ANALYSIS of a SAMPLE of WATER from the SPRING IN THE FIELD.

Received 24th February 1888.

Description.—The water is bright in appearance, but slightly turbid owing to particles of floating matter, apparently mineral.

The residue left on evaporation is nearly white.

Appearance in two-foot tube: bluish tint, good colour.

The results of the analysis are stated in grains per gallon.

| | Grains. |
|--|---------|
| Total dissolved solid matter - - - - - | 35· |
| Chlorine as chlorides - - - - - | 1·0 |
| Ammonia, free and saline - - - - - | ·006 |
| Ditto albuminoid - - - - - | ·005 |
| Nitrogen as nitrates - - - - - | ·070 |
| Ditto as nitrites - - - - - | 0 |
| Oxygen required to oxidise organic matter in three hours - | 0 |
| Total hardness - - - - - | 31· |
| Hardness after boiling - - - - - | 9·4 |

Remarks.—The water contains more than the usual amount of dissolved solid matter, but the chlorides and nitrates are perfectly normal in quantity. The water contains no free ammonia nor nitrates, and an extremely small amount of organic matter. The dissolved matter largely consists of carbonate of lime, of which two-thirds is removed by boiling; the water is consequently a distinctly hard water. I consider the sample has the composition and characters of a pure natural water and is fit for drinking and general use.

(Signed) W. W. FISHER,
Public Analyst.

Oxford, dated 28th February 1888.

(Reference No. 715.)

TO SUPERINTENDENT NOBES, H. C. for the Town Council, Buckingham.

REPORT of the ANALYSIS of a SAMPLE of WATER from the PUBLIC SUPPLY, BATH LANE.

Received 24th February.

Description.—The water is slightly turbid and contains some floating particles of vegetable tissue.

On evaporation a residue is left which is nearly white, and contains only a trace of brown organic matter.

Appearance in two-foot tube: bluish tint, good colour.

The results of the analysis are stated in grains per gallon.

| | Grains. |
|--|---------|
| Total dissolved solid matter - - - - - | 37.5 |
| Chlorine as chlorides - - - - - | 1.1 |
| Ammonia, free and saline - - - - - | .006 |
| Ditto albuminoid - - - - - | .005 |
| Nitrogen as nitrates - - - - - | .070 |
| Ditto as nitrites - - - - - | 0 |
| Oxygen required to oxidise organic matter in three hours - | 0 |
| Total hardness - - - - - | 31 |

Remarks.—This sample of water is almost identical in character with No. 716, and in my opinion is equally good in character and fit for drinking.

(Signed)

W. W. FISHER,
Public Analyst.

Oxford, dated 28th February 1888.

APPENDIX II.

(Reference No. 666.)

To Mr. J. NOBES, H. C.

REPORT of the ANALYSIS of a SAMPLE of WATER from BUCKINGHAM. No. 2 R.O.

Received 23 August 1887.

Description.—The water is turbid with a slight weedy or muddy odour.

Appearance in two-foot tube: yellowish, turbid.

The results of the analysis are stated in grains per gallon.

| | Grains. |
|--|---------|
| Total dissolved solid matter - - - - - | 22 |
| Chlorine as chlorides - - - - - | 1.2 |
| Ammonia, free and saline - - - - - | .008 |
| Ditto albuminoid - - - - - | .021 |
| Nitrogen as nitrates - - - - - | .014 |
| Ditto as nitrites - - - - - | Trace |
| Oxygen required to oxidise organic matter in three hours - | .091 |

Remarks.—The solid matters and the chlorides and nitrates are such as would be found in a good water, but this water contains traces of ammonia, of nitrites and some excess of organic matter. It does not appear from the analysis to contain sewage matters; but the sample has the general characters of a surface or river water. It is not of first-class quality, but if properly filtered would be satisfactory for domestic uses and drinking.

(Signed)

W. W. FISHER,
Public Analyst.

Oxford, dated 26th August 1887.

RECOMMENDATIONS.

1. The Town Council should obtain skilled engineering advice as to the steps necessary for the improvement of the sewerage, bearing in mind the necessity for providing ventilation and means of flushing, and for avoiding pollution of the river.

2. House drains which are defective should be reconstructed. Drains should not open in the interior of a house, but all sink and waste pipes should discharge in the open air towards a trapped gully. Such house drains as are of any considerable length should be trapped off below from the sewer and ventilated with double openings according to the principles of the Model Byelaws.

3. The advice of an engineer should also be obtained as to the best way of supplying the town with water from an extra-urban source or sources. In the meantime the security of existing supplies should be looked after, and risks of pollution so far as possible removed.

4. Privies which are a source of nuisance or endanger the purity of water supplies should be removed or reconstructed on improved principles. Indoor waterclosets should have the soil-pipe fixed outside the house, and carried up full bore as a ventilating shaft, as nearly straight as possible, to end above the roof.

Until however proper sewers and a more abundant water supply are available, the extended use of waterclosets is not recommended (except where owing to want of space or other reason it is necessary to place the closet in or close to the house), and pail-closets, or privies with small water tight pits frequently emptied, are preferable.

5. Steps should be taken to cause houses which from dilapidation, dampness, want of proper ventilation or other cause are unfit for habitation or prejudicial to health to be made fit for habitation or to be closed (sections 91 and 97 Public Health Act, 1875). Overcrowding should be prevented. Houses in a filthy or unwholesome condition should be cleaned and white-washed (section 46 Public Health Act).

The Town Council should consider the advisability of taking action under the Housing of the Working Classes Act, 1885, and associated Acts, for the providing of suitable dwellings for the working classes.

6. The Town Council should provide a place for the isolation and treatment of persons suffering from infectious diseases who have not proper accommodation in their own houses. Such provision need not be on a large or expensive scale, but it is essential to its usefulness that it should be kept in readiness for the reception of the earliest cases that may occur, in order that by the isolation of these the further spread of the disease may be prevented.
